FINAL REPORT

EXECUTIVE SUMMARY

SR 87/SR 260/ SR 377 Corridor Profile Study

Junction 202L to Junction I-40

PREPARED FOR ADOT MARCH 2017

ADOT WORK TASK NO.
MPD 028-16

ADOT CONTRACT NO.
11-013152

Prepared by

Kimley»Horn

SR 87/SR 260/SR 377 CORRIDOR PROFILE STUDY

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ARIZONA DEPARTMENT OF TRANSPORTATION

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EXECUTIVE SUMMARY

INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of State Route 87 (SR 87)/State Route 260 (SR 260)/State Route 377 (SR 377) between State Route 202L (Loop 202) and Interstate 40 (I-40). This study examines key performance measures relative to the SR 87/SR 260/SR 377 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven CPS within three separate groupings. The SR 87/SR 260/SR 377 corridor, depicted in **Figure ES-1**, is one of the strategic statewide corridors identified and the subject of this CPS.

Corridor Study Purpose, Goals and Objectives

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

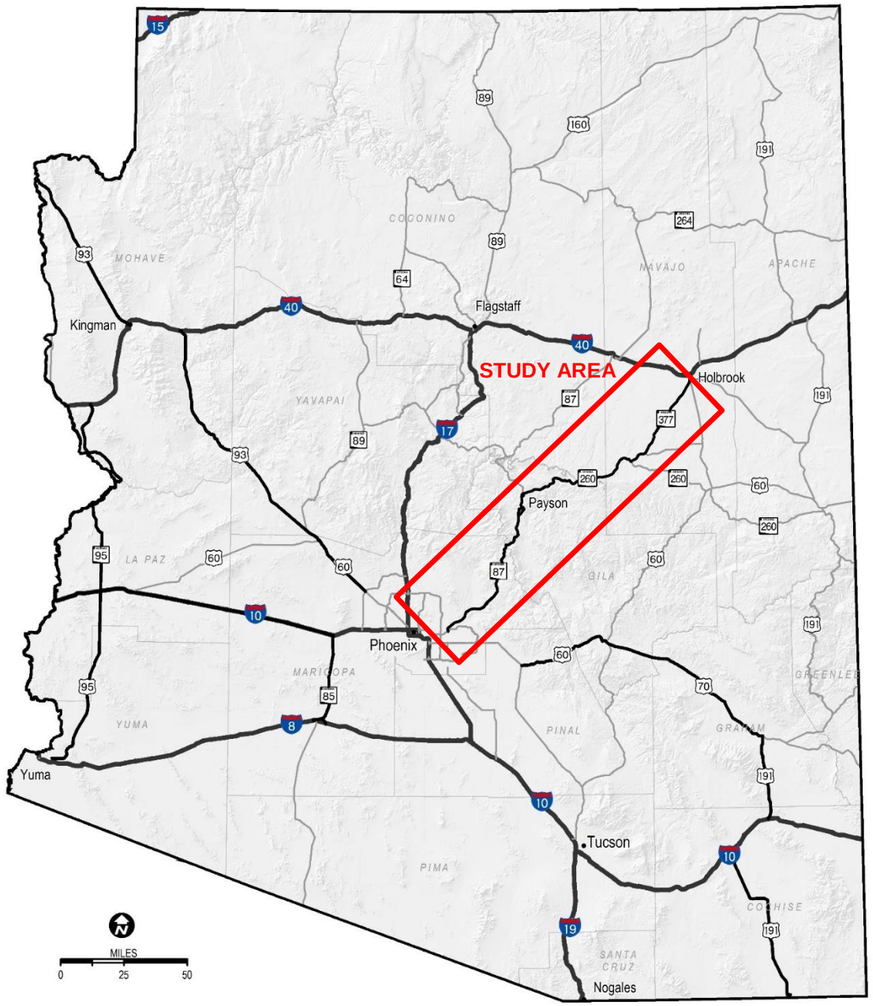
- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation, accounting for performance effectiveness and risk analysis findings

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The SR 87/SR 260/SR 377 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals are identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

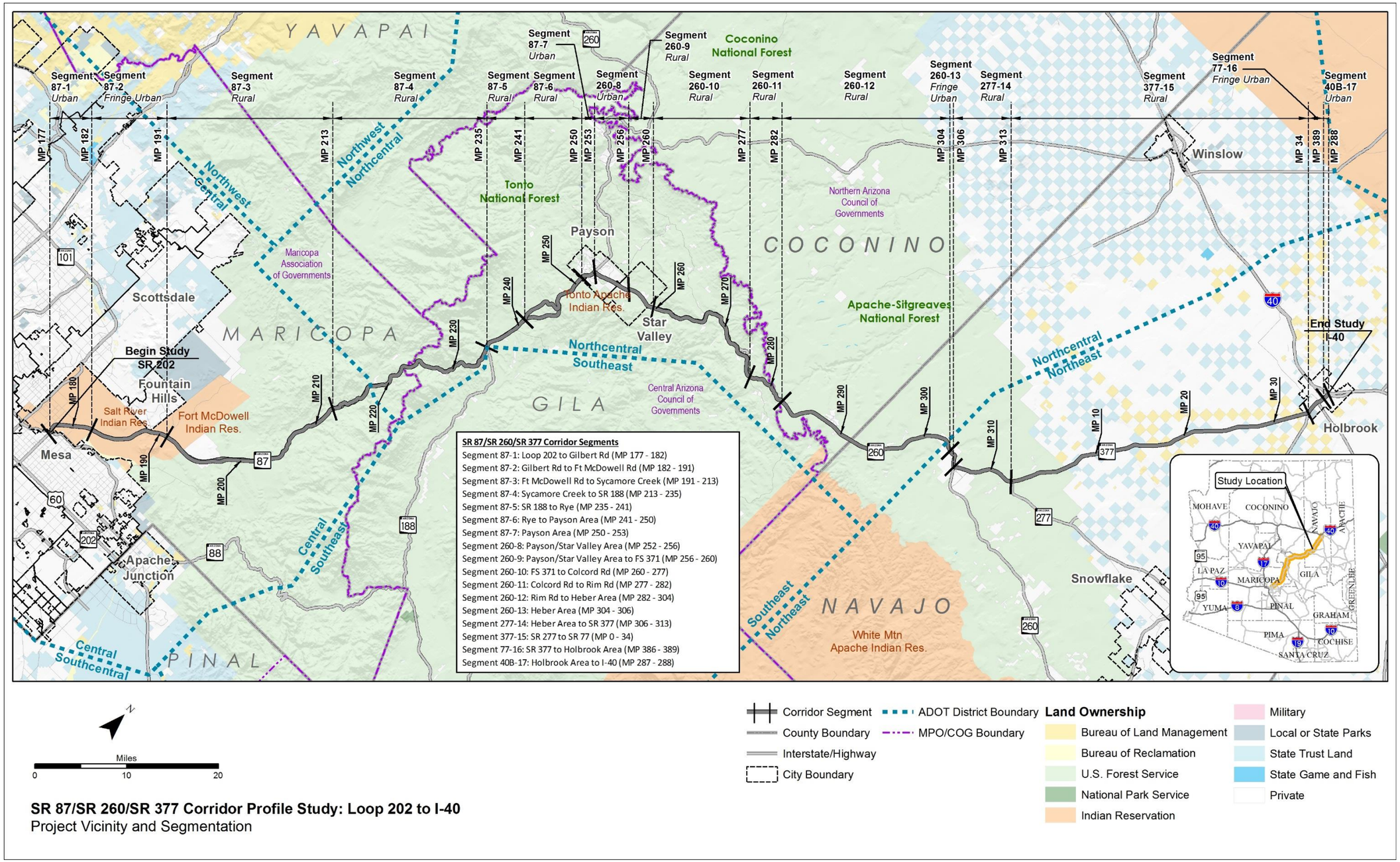
Figure ES-1: Corridor Study Area



Study Location and Corridor Segments

The SR 87/SR 260/SR 377 corridor is divided into 17 planning segments for analysis and evaluation. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are shown in **Figure ES-2**.

Figure ES-2: Corridor Location and Segments



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Project Vicinity and Segmentation

CORRIDOR PERFORMANCE

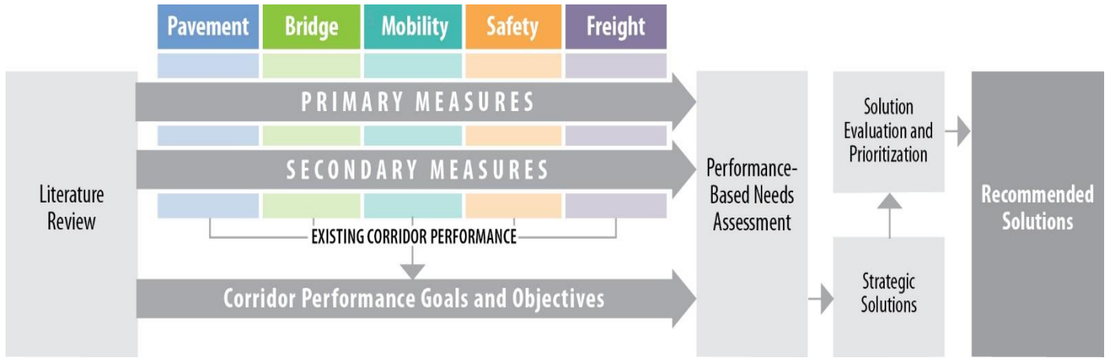
A series of performance measures is used to assess the SR 87/SR 260/SR 377 corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

Figure ES-3 illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance.

Figure ES-3: Corridor Profile Performance Framework



The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance. **Table ES-1** provides the complete list of primary and secondary performance measures for each of the five performance areas.

Table ES-1: Corridor Performance Measures

Performance Area	Primary Measure	Secondary Measures
Pavement	**Pavement Index** Based on a combination of International Roughness Index and cracking	• Directional Pavement Serviceability • Pavement Failure • Pavement Hot Spots
Bridge	**Bridge Index** Based on lowest of deck, substructure, superstructure and structural evaluation rating	• Bridge Sufficiency • Functionally Obsolete Bridges • Bridge Rating • Bridge Hot Spots
Mobility	**Mobility Index** Based on combination of existing and future daily volume-to-capacity ratios	• Future Congestion • Peak Congestion • Travel Time Reliability • Multimodal Opportunities
Safety	**Safety Index** Based on frequency of fatal and incapacitating injury crashes	• Directional Safety Index • Strategic Highway Safety Plan Emphasis Areas • Crash Unit Types • Safety Hot Spots
Freight	**Freight Index** Based on bi-directional truck planning time index	• Recurring Delay • Non-Recurring Delay • Closure Duration • Bridge Vertical Clearance • Bridge Vertical Clearance Hot Spots

Each of the primary and secondary performance measures identified in the table above is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance – Rating is above the identified desirable/average range

Fair/Average Performance – Rating is within the identified desirable/average range

Poor/Below Average Performance – Rating is below the identified desirable/average range

The terms “good”, “fair”, and “poor” apply to the Pavement, Bridge, Mobility, and Freight performance measures, which have defined thresholds. The terms “above average”, “average”, and “below average” apply to the Safety performance measures, which have thresholds referenced to statewide averages.

Corridor Performance Summary

Table ES-2 shows a summary of corridor performance for all primary measures and secondary measure indicators for the SR 87/SR 260/SR 377 corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure as shown in **Table ES-2**. The following general observations were made related to the performance of the SR 87/SR 260/SR 377 corridor:

- Overall Performance: The Pavement, Bridge, and Mobility performance areas show generally "good" or "fair" performance; Safety and Freight performance areas show generally "poor/below average" or "fair/average" performance
- Pavement Performance: The weighted average of the Pavement Index shows "good" overall performance; exceptions include Segments 260-13, 277-14, and 77-16, which show either "poor" or "fair" performance for the Pavement Index, Directional Pavement Serviceability Rating (PSR), and % Area Failure measures; no data was available for Segment 40B-17
- Bridge Performance: The weighted average of the Bridge Index shows "good" overall performance; all segments that include bridges have "good" or "fair" performance for Bridge Index, Sufficiency Rating, and Lowest Bridge Rating measures; Segment 77-16 shows "poor" performance for the % of Deck Area on Functionally Obsolete Bridges; Segments 87-6, 87-7, 260-8, 260-9, 277-14, 377-15, and 40B-17 contain no bridges
- Mobility Performance: The weighted average of the Mobility Index shows "good" overall performance; Closure Extent, Directional Planning Time Index (PTI), % Bicycle Accommodation, and % Non-Single Occupancy Vehicle (SOV) Trips show "poor" or "fair" performance for the corridor; Segments 87-2, 87-7, 260-9, and 77-16 show either "poor" or "fair" performance in the Mobility Index and Future Daily V/C measures
- Safety Performance: The weighted average of the Safety Index and Directional Safety Index show "below average" overall performance; in the 2010-2014 analysis period, there were 48 fatal crashes and 81 incapacitating crashes on the corridor; Segments 87-7, 260-9, 260-13, 277-14, 77-16, and 40B-17 have "insufficient data", meaning that there was not enough data available to generate reliable performance ratings so no values were calculated
- Freight Performance: The weighted average of the Freight Index shows "poor" performance; Closure Duration, Directional Truck Travel Time Index (TTTI), and Directional Truck PTI show "poor" or "fair" performance for the corridor; no TTTI or TPTI data was available for Segments 277-14 and 377-15; no Closure Duration data was available for Segment 40B-17
- Lowest Performing Segments: Segments 87-3, 87-4, 260-9, and 77-16 show "poor/below average" performance for many performance measures
- Highest Performing Segments: Segments 87-2 and 87-7 show "good/above average" performance for many performance measures

Table ES-2: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area											
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/ milepost/year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
			NB/EB	SB/WB								NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB		
87-1[1*a]	5	4.19	4.03	4.11	10.0%	7.00	85.00	0.0%	7	0.65	0.86	0.34	0.34	0.37	0.32	1.22	1.06	4.01	3.03	45%	13.6%
87-2[1* a]	9	4.25	4.01	4.14	0.0%	7.00	96.50	0.0%	7	0.73	1.01	0.45	0.45	0.46	0.04	1.15	1.23	2.36	3.86	93%	14.4%
87-3[2^ a]	22	3.80	3.80	3.88	11.4%	6.95	96.20	0.0%	6	0.21	0.29	0.14	0.13	0.87	0.11	1.05	1.04	1.54	1.48	99%	16.7%
87-4[2^ a]	22	4.05	3.84	3.93	0.0%	6.31	89.18	0.0%	6	0.23	0.27	0.20	0.21	1.47	0.15	1.17	1.05	2.05	1.47	86%	5.2%
87-5[2^ a]	5	4.55	4.35	4.36	0.0%	6.31	99.60	0.0%	6	0.15	0.14	0.15	0.15	0.23	0.07	1.01	1.08	1.42	1.51	92%	12.9%
87-6[2^ a]	10	4.15	4.10	3.96	0.0%	No Bridges				0.21	0.21	0.19	0.19	0.18	0.27	1.31	1.15	2.38	1.94	79%	12.4%
87-7[1* b]	2	3.54	3.36	3.48	0.0%	No Bridges				0.75	0.94	0.57	0.50	0.07	0.20	1.18	1.86	4.43	6.48	56%	18.4%
260-8[1* b]	4	4.31	4.24		0.0%	No Bridges				0.54	0.68	0.47	0.51	0.05	0.00	1.46	1.10	7.15	4.97	16%	18.5%
260-9[2^ c]	3	4.27	4.12		0.0%	No Bridges				0.94	1.15	1.29	1.33	0.30	0.55	1.12	1.00	1.61	1.16	2%	15.1%
260-10[2^ a]	17	4.03	3.79	3.81	0.0%	6.81	99.52	0.0%	6	0.08	0.08	0.13	0.11	0.49	0.48	1.13	1.06	1.64	1.40	93%	16.2%
260-11[2^ c]	5	4.13	3.98		0.0%	6.73	79.13	0.0%	6	0.12	0.14	0.14	0.13	0.40	0.88	1.23	1.00	2.16	1.14	49%	12.5%
260-12[2^ c]	22	3.78	3.52		4.5%	7.00	98.40	0.0%	7	0.36	0.39	0.34	0.34	0.43	0.85	1.00	1.05	1.18	1.36	2%	10.8%
260-13[1^ b]	2	3.11	2.87		50.0%	6.00	93.70	0.0%	6	0.14	0.15	0.14	0.14	0.00	0.40	1.02	1.21	1.63	2.98	15%	6.7%
277-14[2^ c]	7	2.05	3.03		71.4%	No Bridges				0.09	0.10	0.07	0.06	0.11	0.00	No Data				0%	17.5%
377-15[2^ c]	34	4.12	4.03		0.0%	No Bridges				0.09	0.10	0.13	0.13	0.04	0.05	No Data				0%	18.2%
77-16[1* c]	2	3.25	3.10		40.0%	6.00	59.00	100.0%	6	0.85	1.09	0.60	0.65	0.00	0.00	1.08	1.49	3.84	6.79	1%	18.7%
40B-17[1* b]	1	No Data				No Bridges				0.45	0.57	0.32	0.32	No Data		1.80	1.31	12.93	10.56	27%	20.7%
Weighted Corridor Average		3.94	3.83	3.86	6.4%	6.70	95.46	1.6	6.06	0.26	0.32	0.24	0.23	0.49	0.27	1.13	1.09	2.15	2.03	49%	14.0%

SCALES

Performance Level	Non-Interstate		All				Urban and Fringe Urban	All	Uninterrupted		All	
Good/Above Average	> 3.50	< 5%	> 6.5	> 80	< 12%	> 6	< 0.71	< 0.22	< 1.15	< 1.3	> 90%	> 17%
Fair/Average	2.90 - 3.50	5% - 20%	5.0 - 6.5	50 - 80	12% - 40%	5 - 6	0.71 - 0.89	0.22 - 0.62	1.15 - 1.33	1.3 - 1.5	60% - 90%	11% - 17%
Poor/Below Average	< 2.90	> 20%	< 5.0	< 50	> 40%	< 5	> 0.89	> .62	> 1.33	> 1.5	< 60%	< 11%

Performance Level	Rural	Interrupted	
Good/Above Average	< 0.56	< 1.3	< 3.0
Fair/Average	0.56 - 0.76	1.3 – 2.0	3.0 – 6.0
Poor/Below Average	> 0.76	> 2.0	> 6.0

^Uninterrupted Flow Facility
*Interrupted Flow Facility
[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway
[1]Urban Operating Environment
[2]Rural Operating Environment

Table ES-2: Corridor Performance Summary by Segment and Performance Measure (continued)

Segment #	Segment Length (miles)	Safety Performance Area							Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Freight Index	Directional TTTI		Directional TPTI		Closure Duration (minutes/milepost/year/mile)		Bridge Vertical Clearance (feet)
			NB/EB	SB/WB						NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	
87-1[1]*	5	3.01	4.05	1.98	29%	Insufficient Data	Insufficient Data	Insufficient Data	0.28	1.29	1.10	3.88	3.38	129.19	61.92	No UP
87-2[1]*	9	0.62	1.21	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.29	1.19	1.32	2.72	4.06	119.84	147.44	No UP
87-3[2]^	22	1.19	0.48	1.90	44%	Insufficient Data	39%	Insufficient Data	0.53	1.11	1.23	1.38	2.38	2674.13	59.23	16.97
87-4[2]^	22	1.62	1.48	1.76	30%	Insufficient Data	50%	Insufficient Data	0.51	1.37	1.14	2.38	1.56	4359.89	34.01	18.75
87-5[2]^	5	1.22	0.08	2.36	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.56	1.12	1.21	1.45	2.13	49.20	21.67	No UP
87-6[2]^	10	2.11	0.09	4.13	71%	Insufficient Data	14%	Insufficient Data	0.44	1.55	1.22	2.52	2.01	37.16	287.98	No UP
87-7[1]*	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.28	1.20	1.91	3.29	3.88	21.33	693.60	No UP
260-8[1]*	4	0.28	0.56	0.00	43%	Insufficient Data	Insufficient Data	Insufficient Data	0.15	1.66	1.17	9.64	4.11	11.45	0.00	No UP
260-9[2]^	3	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.47	1.20	1.00	3.09	1.21	71.85	726.90	No UP
260-10[2]^	17	0.93	0.62	1.24	50%	Insufficient Data	13%	Insufficient Data	0.58	1.23	1.12	1.82	1.61	157.49	797.71	No UP
260-11[2]^	5	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.54	1.45	1.00	2.53	1.18	144.40	922.04	No UP
260-12[2]^	22	1.43	2.25	0.62	46%	Insufficient Data	15%	Insufficient Data	0.69	1.00	1.10	1.19	1.69	117.01	901.62	No UP
260-13[1]^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.36	1.09	1.35	2.75	2.82	0.00	739.30	No UP
277-14[2]^	7	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					20.03	0.00	No UP
377-15[2]^	34	1.18	1.21	1.16	82%	Insufficient Data	0%	Insufficient Data	No Data					10.14	9.29	No UP
77-16[1]*	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.22	1.12	1.54	3.52	5.65	0.00	0.00	No UP
40B-17[1]*	1	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.05	2.15	1.51	29.93	8.45	No Data		No UP
Weighted Corridor Average		1.32	1.20	1.45	54%	Insufficient Data	21%	Insufficient Data	0.50	1.24	1.18	2.46	2.25	957.0	289.9	17.87

SCALES

Performance Level	2 or 3 or 4 Lane Divided Highway					Uninterrupted			All	
Good/Above Average	< 0.77	< 44%	< 4%	< 16%	< 2%	> 0.77	< 1.15	< 1.3	< 44.18	> 16.5
Fair/Average	0.77 - 1.23	44% - 54%	4% - 7%	16% - 26%	2% - 4%	0.67 - 0.77	1.15 - 1.33	1.3 - 1.5	44.18-124.86	16.0 - 16.5
Poor/Below Average	> 1.23	> 54%	> 7%	> 26%	> 4%	< 0.67	> 1.33	> 1.5	> 124.86	< 16.0
Performance Level	**2 or 3 Lane Undivided Highway**					**Interrupted**				
Good/Above Average	< 0.94	< 51%	< 6%	< 19%	< 5%	> 0.33	< 1.3	< 3.0		
Fair/Average	0.94 - 1.06	51% - 58%	6% - 10%	19% - 27%	5% - 8%	0.17 - 0.33	1.3 - 2.0	3.0 - 6.0		
Poor/Below Average	> 1.06	> 58%	> 10%	> 27%	> 8%	< 0.17	> 2.0	> 6.0		
Performance Level	**4 or 5 Undivided Highway**									
Good/Above Average	< 0.80	< 42%	< 6%	< 6%	< 5%					
Fair/Average	0.80 - 1.20	42% - 51%	6% - 10%	6% - 9%	5% - 8%					
Poor/Below Average	> 1.20	> 51%	> 10%	> 9%	> 8%					

^Uninterrupted Flow Facility
*Interrupted Flow Facility

[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway

[1]Urban Operating Environment
[2]Rural Operating Environment

Notes: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings
"No UP" indicates no underpasses are present in the segment

NEEDS ASSESSMENT

Corridor Description

The SR 87/SR 260/SR 377 corridor is an important travel corridor in the central/northeastern part of the state. The corridor functions as a route for recreational, tourist, and regional traffic and provides critical connections between the communities it serves and the rest of the regional and interstate network.

Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to SR 87/SR 260/SR 377 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three "emphasis areas" were identified for the SR 87/SR 260/SR 377 corridor: Mobility, Safety, and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and performance objectives.

Needs Assessment Process

The performance-based needs assessment evaluates the difference between the baseline performance and the performance objectives for each of the five performance areas used to characterize the health of the corridor: Pavement, Bridge, Mobility, Safety, and Freight. The performance-based needs assessment process is illustrated in **Figure ES-4**.

The needs assessment compares baseline corridor performance with performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown in **Figure ES-5**.

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. A detailed review of available data helps identify contributing factors to the need and if there is a high level of historical investment.

Figure ES-4: Needs Assessment Process

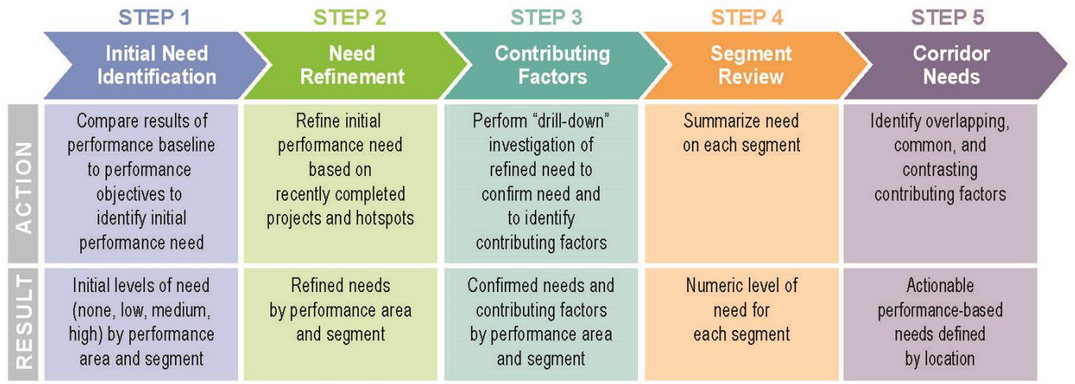


Figure ES-5: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None*	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
	Fair		
	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
5.0	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Summary of Needs

Table ES-3 provides a summary of needs for each segment across all performance areas, with the average need score for each segment presented in the last row of the table. A weighting factor of 1.5 is applied to the need scores of the performance areas identified as emphasis areas (Mobility, Safety, and Freight for the SR 87/SR 260/SR 377 corridor). There is one segment with a High average need (77-16), fourteen segments with a Medium average need, and two segments with a Low average need. More information on the identified final needs in each performance area is provided below.

Pavement Needs

- Seven segments (87-1, 87-3, 87-4, 260-12, 260-13, 277-14, and 77-16) contain Pavement hot spots, but one of these segments had recent paving projects that addressed the need
- Segments 87-1, 87-3, 87-4, and 40B-17 have final needs of Low and Segments 260-13 and 77-16 have final needs of Medium. Segment 277-14 is the only High need segment of the corridor; all other segments of the corridor have a final need of None

Bridge Needs

- Seven segments (87-6, 87-7, 260-8, 260-9, 277-14, 377-15, and 40B-17) do not include any bridges
- Segment 77-16 includes one bridge, the Little Colorado River Bridge, which is functionally obsolete
- There are no final Bridge needs along the corridor

Mobility Needs

- Low Mobility needs exist on fifteen of the seventeen segments of the corridor
- Two segments (260-9 and 77-16) have High final needs
- Segment 260-9 has high existing, directional, and future V/C needs
- Many segments contain Medium or High directional PTI needs
- Bicycle accommodation needs are High on ten of the seventeen segments of the corridor

Safety Needs

- High Safety needs exist on six of the seventeen segments
- Safety hot spots exist in Segments 87-4, 87-6, and 260-8
- Many of the segments of the corridor (87-7, 260-9, 260-11, 260-13, 277-14, 77-16, 40B-17) contain insufficient data to determine levels of need, so a need value is not available (N/A)

Freight Needs

- High Freight needs exist on eleven of the seventeen segments
- Many segments of the corridor contain High directional PTI and closure duration needs
- No Freight hot spots exist along the corridor
- Segments 277-14 and 377-15 have no data to determine a level of need

Overlapping Needs

This section identifies overlapping performance needs on the SR 87/SR 260/SR 377 corridor, which provides guidance to develop strategic solutions that address more than one performance area with elevated levels of need. Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below:

- Segments 87-3, 87-4, 87-5, 87-6 and 260-12 all contain elevated needs in the Safety and Freight performance areas
- Segment 77-16, which has the highest average need score of all the segments of the corridor, has elevated needs in the Pavement, Mobility, and Freight performance areas
- Segment 260-9 contains elevated needs in the Mobility and Freight performance areas

Table ES-3: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)																
	87-1	87-2	87-3	87-4	87-5	87-6	87-7	260-8	260-9	260-10	260-11	260-12	260-13	277-14	377-15	77-16	40B-17^
	MP 177-182	MP 182-191	MP 191-213	MP 213-235	MP 235-241	MP 241-250	MP 250-253	MP 252-256	MP 256-260	MP 260-277	MP 277-282	MP 282-304	MP 304-306	MP 306-313	MP 0-34	MP 386-389	MP 287-288
Pavement	Low	None	Low	Low	None	None	None	None	None	None	None	None	Medium	High	None	Medium	Low
Bridge	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Low	None
Mobility[+]	Low	Low	Low	Low	Low	Low	Low	Low	High	Low	Low	Low	Low	Low	Low	High	Low
Safety[+]	High	Low	High	High	Medium	High	N/A[#]	Low	N/A	Low	N/A	High	N/A	N/A	High	N/A	N/A
Freight[+]	Low	Low	High	High	High	High	Low	High	High	High	High	High	High	N/A	N/A	Medium	High
Average Need	**1.31**	**0.69**	**1.77**	**1.77**	**1.38**	**1.62**	**0.60**	**1.15**	**1.80**	**1.15**	**1.20**	**1.62**	**1.60**	**1.29**	**1.20**	**2.10**	**1.40**

** A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

[+] *Identified as an emphasis area for the SR 87/SR 260/SR 377 corridor.*

 # N/A indicates insufficient or no data available to determine level of need

^ Segment 40B-17 Pavement Need estimated based on field review

Average Need Scale	
None*	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State's key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need as addressing these needs will have the greatest effect on corridor performance. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. The SR 87/SR 260/SR 377 strategic investment areas (resulting from the elevated needs) are shown in **Figure ES-6**.

Screening Process

In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures including:

- A project is programmed to address this need
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment or rating issues; these hot spots will likely be addressed through other ADOT programming means
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need; this bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project)
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need

Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 87/SR 260/SR 377 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

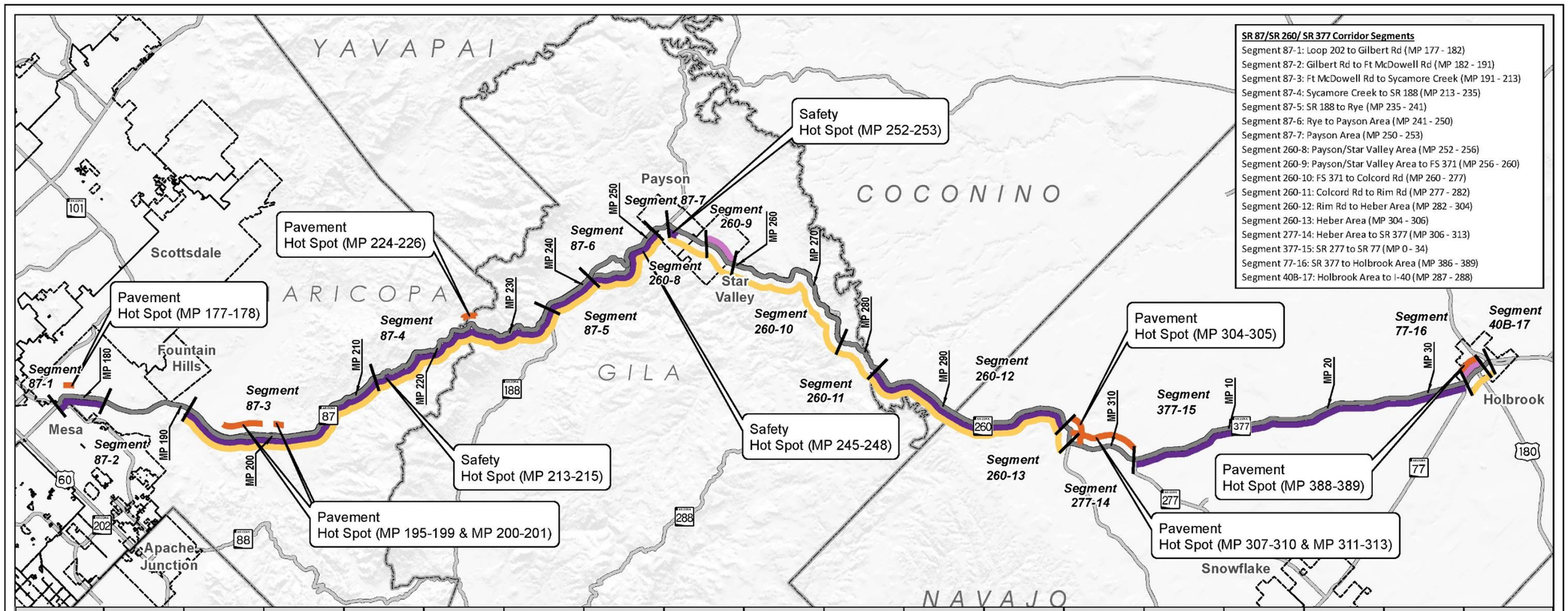
Candidate solutions include some or all of the following characteristics:

- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance areas include two options; rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

Figure ES-6: Strategic Investment Areas



Performance Area	87-1 MP 177-182	87-2 MP 182-191	87-3 MP 191-213	87-4 MP 213-235	87-5 MP 235-241	87-6 MP 241-250	87-7 MP 250-253	260-8 MP 252-256	260-9 MP 256-260	260-10 MP 260-277	260-11 MP 277-282	260-12 MP 282-304	260-13 MP 304-306	277-14 MP 306-313	377-15 MP 0-34	77-16 MP 386-389	40B-17^ MP 287-288	Performance Area
Pavement	Hot Spot	-	Hot Spot	Hot Spot	-	-	-	-	-	-	-	-	Medium	High	-	Medium	-	Pavement
Bridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Bridge
Mobility*	-	-	-	-	-	-	-	-	High	-	-	-	-	-	-	High	-	Mobility*
Safety*	High	-	High	High	Medium	High	N/A#	Hot Spot	N/A	-	N/A	High	N/A	N/A	High	N/A	N/A	Safety*
Freight*	-	-	High	High	High	High	-	High	High	High	High	High	High	N/A	N/A	Medium	High	Freight*

* Identified as emphasis area for SR 87/SR 260/SR 377 Corridor

^40B-17 Pavement Need estimated bases on field review

N/A indicate insufficient or no data available to determine level of need

Note: Figure shows strategic investment areas, which are segments with Medium and High levels of need and locations of hot spots. A "-" symbol indicates a segment level of need of Low or None, which is not considered strategic

SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Strategic Investment Areas

Miles
0 9 18

Performance Area Needs

- Corridor Segment
- County Boundary
- Interstate/Highway
- City Boundary
- Pavement
- Mobility
- Safety
- Freight
- Bridge

Level of Need
Low
Medium
High

SOLUTION EVALUATION AND PRIORITIZATION

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation is shown in Figure ES-7 and described more fully below.

Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

All Mobility, Safety, and Freight strategic investment areas that result in multiple independent candidate solutions are advanced directly to the Performance Effectiveness Evaluation.

Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

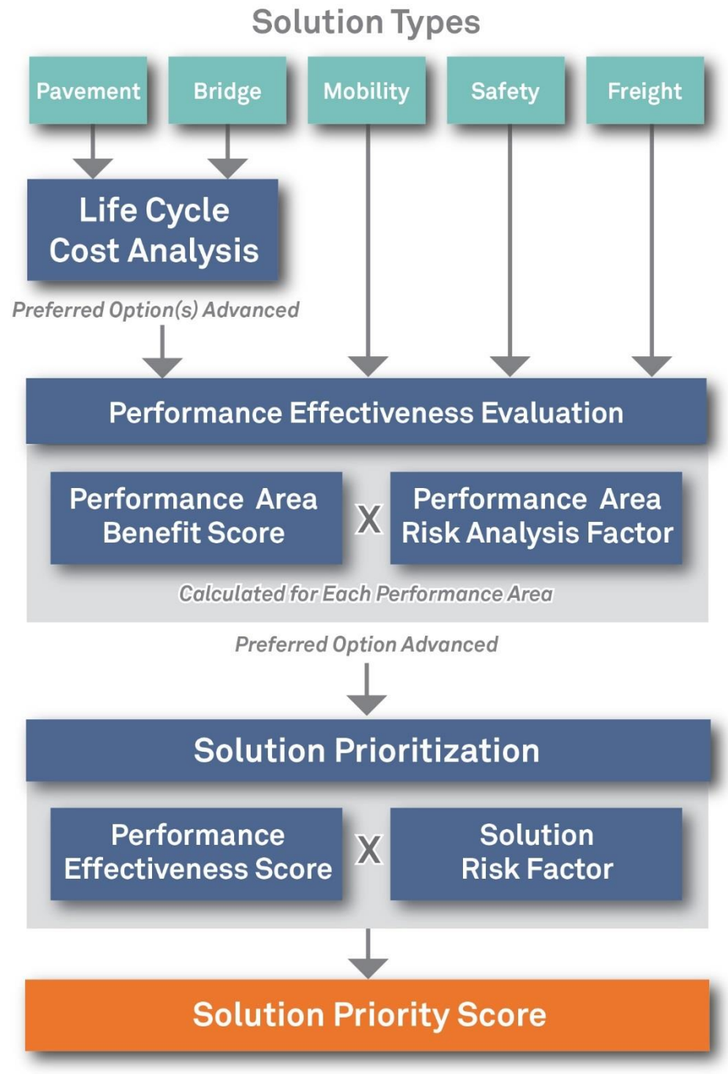
Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure.

Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure ES-7: Candidate Solution Evaluation Process



SUMMARY OF CORRIDOR RECOMMENDATIONS

Prioritized Candidate Solution Recommendations

Table ES-4 and **Figure ES-8** show the prioritized candidate solutions recommended for the SR 87/SR 260/SR 377 corridor. Implementation of these solutions is anticipated to improve performance of the SR 87/SR 260/SR 377 corridor, primarily in the Mobility, Safety, and Freight performance areas. The highest priority solutions address needs in the Rye area (SR 87 MP 235-241), Salt River area (SR 87 MP 177-182), and near the Payson area (SR 87 MP 246-251).

Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor-specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the SR 87/SR 260/SR 377 corridor:

- Implement a driving impaired and speeding safety education campaign along the corridor
- Coordinate with the Arizona Game and Fish Department (AGFD) to conduct a study on vehicle/wildlife conflicts on SR 87 between MP 233 and 241
- Conduct an access management study on SR 87 and SR 260 through the Town of Payson

Policy and Initiative Recommendations

In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through the CPS process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on the SR 87/SR 260/SR 377 corridor, but across the entire state highway system where conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic messaging signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects; in pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is recommended to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

Next Steps

Candidate solutions developed for the SR 87/SR 260/SR 377 corridor will be considered along with other candidate projects in the ADOT statewide programming process. It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendation from such studies are still relevant to addressing the ultimate corridor objectives.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.

Table ES-4: Prioritized Recommended Solutions

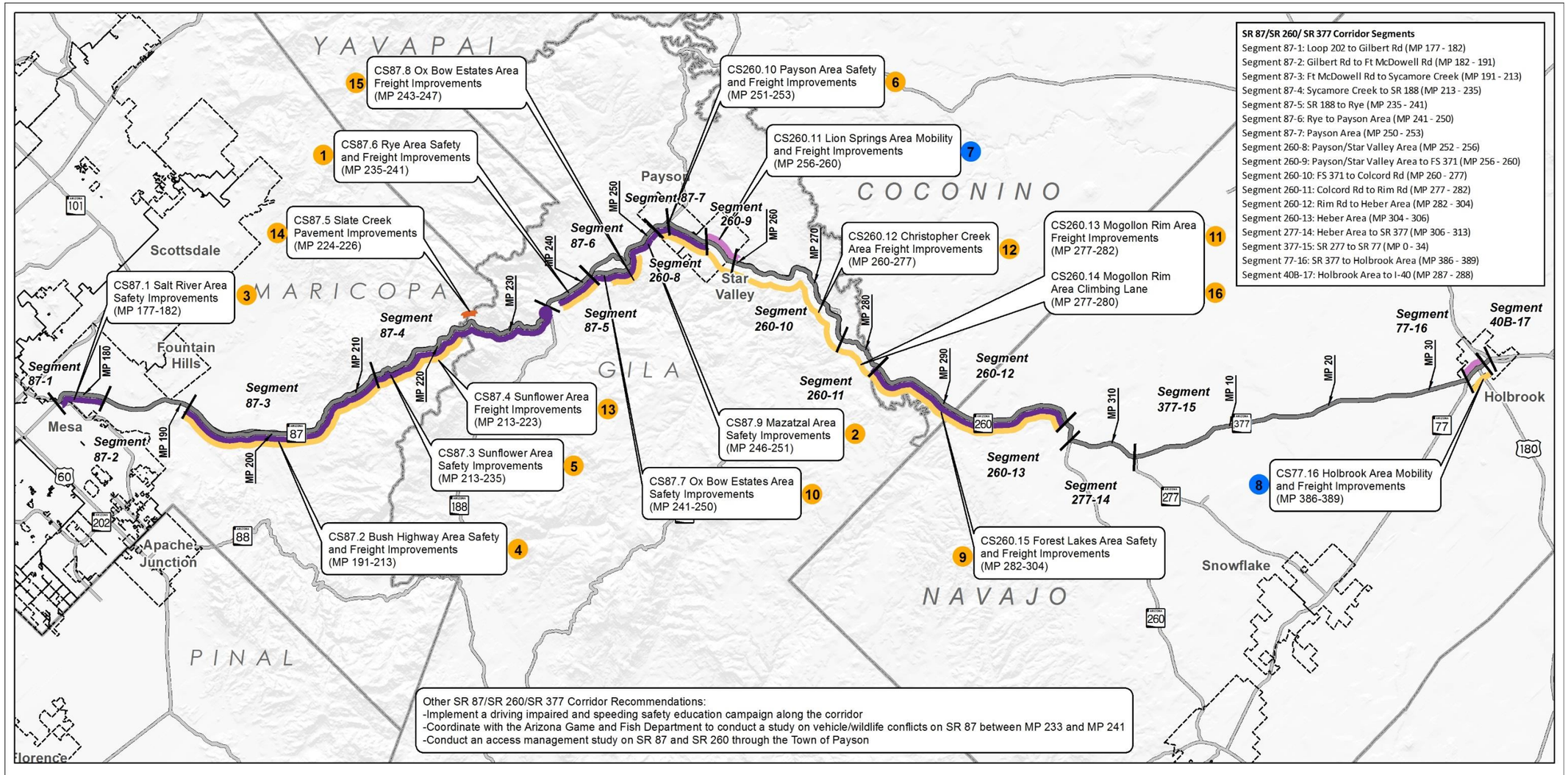
Rank	Candidate Solution #	Option*	Candidate Solution Name	Candidate Solution Scope	Estimated Cost (in millions)	Investment Category (Preservation [P] Modernization [M] Expansion [E])	Prioritization Score
1	CS87.6	-	Rye Area Safety and Freight Improvements (SR 87 MP 235-241)	-Install advisory sign about approaching area with intersections (Deer Creek Drive [MP 237.6], Gisela Road [MP 239.5], two intersections in Rye [MP 240.5 and MP 240.9]) -Install reduced speed advisory sign on SR 87 (NB MP 240, SB MP 241) -Install speed feedback signs (NB MP 240, SB MP 241) -On SR 188 approaching SR 87 add flashing beacons to WB stop sign	$0.2	M	261
2	CS87.9	-	Mazatzal Area Safety Improvements (SR 87 MP 246-251)	-Widen shoulders SB MP 246.2-250.9	$2.3	M	216
3	CS87.1	-	Salt River Area Safety Improvements (SR 87 MP 177-182)	-Install warning signs and chevrons on curved Salt River bridge approaches -Install raised pavement markers along the outside edge line -Install lighting at Oak St (MP 178.0), Center St (MP 179.1), Mesa Dr (MP 179.7), and Camelback Rd (MP 181.1) -Install raised concrete barrier in median on Salt River bridge and approaches (MP 177-177.5)	$4.7	M	212
4	CS87.2	-	Bush Highway Area Safety and Freight Improvements (SR 87 MP 191-213)	-Rehabilitate shoulders (NB/SB MP 194-205) -Install speed feedback signs (NB MP 206.5 and 207.7, NB/SB before curves and intersection with FR 68 [MP 209.6]) -Widen inside shoulders (SB MP 211-209)	$6.8	M	210
5	CS87.3	-	Sunflower Area Safety Improvements (SR 87 MP 213-235)	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (NB MP 213.2, 214.0, 217.8, 220.5, 224.5, 232.5; SB MP 231.0, 229.3, 221.0, 219.6, 216.0, 214.3) -Rehabilitate shoulders -Widen inside shoulders (SB MP 228.5-226.0) -Install rock-fall mitigation (NB MP 214.2-214.6; SB MP 228.9-228.7, 228.5-228.0, 217.6-218.0)	$18.3	M	189
6	CS260.10	-	Payson Area Safety and Freight Improvements (SR 87 MP 251-SR 260 MP 253)	-Implement signal coordination/adaptive control for six signals in Payson urban area (SR 87/SR 260 intersection, SR 260/Payson Village Center, SR 260/Manzanita Dr, SR 87/Main St, SR 87/Bonita St, and SR 87/Green Valley Parkway [BIA101]) -Implement protected/permitted left-turn phasing at SR 87/Manzanita Dr intersection (NB and SB approaches) and provide advance signal advisory sign with flashing beacons WB on SR 260	$0.4	M	171
7	CS260.11	-	Lion Springs Area Mobility and Freight Improvements (SR 260 MP 256-260)	-Reconstruct to 4-lane divided highway (using the existing 2-lane road for one direction) [Design already programmed for FY 2021 in ADOT 5-year program]	$50.0	E	160
8	CS77.16	C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77) (SR 77 MP 386-389)	-Construct new roadway connection between SR 377/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook; includes new bridge over the Little Colorado River and overpass at railroad crossing	$43.8	E	136
		A	*Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)* (SR 77 MP 386-389)	*-Construct new roadway connection between US 180/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook; includes new bridge over the Little Colorado River and overpass at railroad crossing*	*$92.1*	*E*	*67*
		B	*Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)* (SR 77 MP 386-389)	*-Construct overpass at at-grade railroad crossing and new bridge over the Little Colorado River adjacent to existing SR 77 alignment* *-Remove existing Little Colorado River Bridge*	*$75.8*	*E*	*46*
9	CS260.15	-	Forest Lakes Area Safety and Freight Improvements (SR 260 MP 282-304)	-Widen shoulders -Construct alternating passing lanes (varying locations for 11 miles of the segment)	$56.5	M	130
10	CS87.7	-	Ox Bow Estates Area Safety Improvements (SR 87 MP 241-250)	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (SB MP 247, MP 245) -Implement variable speed limits MP 241-246 with new DMS and CCTV SB at MP 247 and new DMS and CCTV NB at MP 240 -Install RWIS at MP 245 with dynamic weather warning beacons	$4.1	M	123
11	CS260.13	-	Mogollon Rim Area Freight Improvements (SR 260 MP 277-282)	-Install centerline rumble strips -Install rock-fall mitigation (WB MP 278.4-278.6, 279.8-280.9, 281.4-282.0) -Install RWIS at MP 282 with dynamic weather warning beacons -Implement variable speed limits at MP 277-282 and new DMS and CCTV at MP 282 WB	$9.5	M	12

Table ES-4: Prioritized Recommended Solutions (continued)

Rank	Candidate Solution #	Option*	Candidate Solution Name	Candidate Solution Scope	Estimated Cost (in millions)	Investment Category (Preservation [P] Modernization [M] Expansion [E])	Prioritization Score
12	CS260.12	-	Christopher Creek Area Freight Improvements (SR 260 MP 260-277)	-Install rock-fall mitigation (WB MP 262.2-262.6, 261.6-261.9, 269.0-269.1, 269.7-269.8, 271.3-271.5; EB MP 269.8-269.9, 272.6-272.7) -Implement variable speed limits at MP 272-277 and new DMS and CCTV at MP 272 EB	$7.2	M	11
13	CS87.4	-	Sunflower Area Freight Improvements (SR 87 MP 213-223)	-Construct NB climbing lane, MP 213-215 and MP 219-223 -Widen Whiskey Springs Bridge, #2515 MP 220.32 -Widen Upper Kitty Joe Bridge, #2497 MP 221.39	$43.4	M	10
14	CS87.5	-	Slate Creek Pavement Improvements (SR 87 MP 224-226)	-Replace Pavement	$7.2	M	9
15	CS87.8	-	Ox Bow Estates Area Freight Improvements (SR 87 MP 243-247)	-Construct NB climbing lane	$22.4	M	2
16	CS260.14	-	Mogollon Rim Area Climbing Lane (SR 260 MP 277-280)	-Construct EB climbing lane	$16.8	M	1

* '-' indicates only one solution is being proposed and no options are being considered

Figure ES-8: Prioritized Recommended Solutions



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Prioritized Recommended Solutions